U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OBSERVATIONS OF GEOTHERMAL ACTIVITY NEAR PAVLOF VOLCANO ON THE ALASKA PENINSULA DURING MARCH AND APRIL OF 1996

By

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Introduction

From March 26 to April 9, 1996, Nancy Pfeiffer and I traversed a section of the Aleutian Range between Cold Bay and Pavlof Bay on foot and on skis, traveling about 90 km (fig 1). This area lies 60-100 km from the end of the Alaska Peninsula and is remote and frequently stormy. The Pavlof observations are of particular interest because of Pavlof's major strombolian eruptions which began September 23, 1996. Much of the terrain we covered was glaciated, which required tying a rope between us to prevent a long fall into a crevasse. Our objectives were to visit two hot spring sites, ascend Pavlof Volcano, and seek out other geothermal features of the region. From Cold Bay, we took a boat directly across the bay and began hiking northeastward. Snow line was at about 300 m, so we carried our skis and sled across the unfrozen lowlands. We first visited Cold Bay Hot Springs, then Emmons Lake Hot Springs and Mount Emmons. After making a high camp on the west flank of Pavlof Volcano, we climbed and skied Pavlof and then endured a four day storm. Next, we climbed through the pass between Little Pavlof and Double Crater and skied down glacier to an active fumarole field on the east flank of Mt. Hague. From there we skied to the glacier's terminus, and hiked across an old aa lava flow to Volcano Bay.

Cold Bay Hot Springs

From the east shore of Cold Bay, we hiked 5 km across unfrozen tundra and sparse alder patches to Cold Bay Hot Springs (fig 2).

The hot springs are located in a fairly nondescript location and are not easy to find. We were able to find them after two hours of traversing the known general vicinity and encountering numerous cold springs that lie upstream. The hot springs occur in small groups in a 300 m by 200 m area on the south side of a 15-m-high elongated hillock, and they drain into a small stream that flows ENE. Grassy tundra and sparse patches of alders cover the rolling topography upstream of the springs, while downstream lies a broad, swampy plain. Brown bear trails radiate from the springs, and blue-green algae line most of the discharge channels; orange bacterial mats occur at some of the hotter springs. At the confluence of springs L, M, N and O (fig. 2) lie the broken remains of what was once a small shelter with a corrugated tin roof. This rubble lies adjacent to the best soaking area in this spring complex.

We found the spring temperatures (ranging from 15° C to 63° C) to be nearly the same as those reported in the Alaska Department of Natural Resources Alaska Open File Report # 144 (Motyka, and others, 1981), with the exception of an additional 39° C spring between springs J and F, and also an unmapped, shallow, cold bubbling pool above spring F. The springs offer a superb view of the west flank of Mt. Dutton, a 1,506-m-high stratovolcano, and no volcanic activity was observed. From the springs, we hiked and skied 21 km northeast to Emmons Lake Caldera.

Emmons Lake

We approached the late Pleistocene Emmons Lake Caldera (fig 3) via the head of the Righthand Valley of the Joshua Green River and skied up over the broad southern plateau that forms the southern caldera rim. From this plateau we viewed the heavily-rimed Aghileen pinnacles, a series of conglomerate spires which are a few hundred meters high. Skiing down a 30-45 degree slope to the NE brought us to Emmons Lake, 500 m below at 335 m elevation. In the snowscape of late March, the ice-free Emmons Lake Hot Springs were obvious (fig 4).

The springs occur at the northwest corner of Emmons Lake 20-30 meters from the lake shore and near a braided stream that flows into the lake (fig 5). Most of the springs join together to form a 1 m by 5 m lakeside pool that is 39-42° C and 0.3 m deep. The spring channels and pool are all lined with orange bacterial and blue-green algae mats. The springs appeared as described in Motyka, and others (1981), except that 1,200 m upstream, we found two undocumented springs that flowed into the east side of the stream, one of which was warm to the touch. Fifteen meters of the lake's black sand beach were ice-free adjacent to the springs, and in the lake, bubbling seeps with yellow discoloration were visible a meter offshore.

These hot springs appear to be popular with local fauna, as we saw several snow buntings as well as a few waterfowl lingering in the warm waters. Additionally, bear tracks emerged through a pass to the west and traversed through the area.

From the hot springs, Mt. Emmons, a 1325-m-high intracaldera stratocone and its satellite cone are visible 4 km to the east. A basalt flow originating from the satellite cone stretches southwestward to Emmons Lake.

Climbing the north flank of Mt. Emmons, we smelled sulfur as we gained the summit. The wind blew 15 knots from the north and we assumed the gas was originating from a prominent fumarole field on Mt. Hague, located 8 km northeast of Mt. Emmons. We skied the southwest face and then climbed into the 130-m-tall satellite cone at the base. The summit crater of the cone was 7 meters deep and 7 meters across. I began to experience a tingling lips sensation after a few minutes in the bottom, so we frantically scurried back out and then skied back to the hot springs. The following day, we skied 16 km northeast of Emmons Lake to the west flank of Pavlof Volcano.

Pavlof Volcano

Camp was made amidst the glacial seracs and rock outcroppings at 900 m on the western flank of Pavlof. We dug into the snow to build snow walls and found the snowpack to consist of dense wind-deposited layers punctuated with ice layers up to 7 cm thick--evidence of the severe weather this region produces. We climbed the northwest face, along a route that is depicted as ash on the USGS 1:63,360-scale Port Moller B-6 map. We assumed this route to be glacier-free and traveled unroped, although we subsequently learned that the face is both glaciated and slightly crevassed. The snow was extremely hard and icy in spots, necessitating the use of crampons.

The top 100 meters of Pavlof's western flank was warm and steamy with numerous small fumaroles, and was generally snow free (fig 6). The 12-meter-long summit ridge was snow covered and had an overhung cornice, which was melted out to the ground in patches. This cornice prevented us from gaining a view of the vents from the 1986-88 eruptions. One steaming melt hole on the summit of the volcano appeared as a meter-wide pseudo-crater in the snow and was directly upslope of the 1986-88 vents. We skied to camp and prepared for an approaching Aleutian storm.

Little Pavlof, Double Crater and Mt. Hague

The weather to this point had been good, but the next four days brought four feet of snow and 50 knots of northwest wind. When conditions allowed us to travel, we made our way through the pass between Little Pavlof and Double Crater (fig 1). Crevasses and seracs on the west side of Little Pavlof were stained sulfur-yellow, apparently from recent gas emissions, though none were observed. Skiing to the top of Double Crater, we saw a steam-choked gully on the east side of Mt. Hague. We made our way to the gully and investigated.

An area 20 meters by 10 meters was melted through the snow and had dozens of fumaroles issuing sulfurous steam continually, creating a din that was audible from 100 m away (fig 7). Boiling water percolated from the yellow-brown dirt in several places, and sulfur crystals coated many rocks (fig 8). A windshift then drove us from the gully with lungfuls of acrid steam. The most active fumarole was isolated from the rest of the field, located below and south of the active part of the gully. It emitted a column of steam 9 m high from a 2-meter-wide hole in the snow. After making the observations, we skied down glacier toward the snow-free coast.

The Lava Field

As we traversed toward the Volcano Bay pickup site, we had to cross 4 km of blocky aa lava flow covered with a treacherously thin layer of snow. The traveling was difficult, taking six hours for the short crossing. The flow originated from a cone 3 km southwest of Mt. Hague's summit and reaches to within a few km of Volcano Bay. This lava flow apparently dammed and diverted the stream which issues from Emmons Lake so that the stream now flows along the margin of the flow. Kennedy and Waldron (1955) labeled this flow as the youngest in the area and estimated it to be a few hundred years old. We can attest to its apparent short exposure to erosional forces and its very dark color.

The beaches at the head of Volcano Bay were firm, and during low water, an appropriate landing site was easy to find for the small, single-engine wheel-equipped aircraft that picked us up.

Acknowledgments

I acknowledge the endurance and good judgement exhibited by my partner, Nancy Pfeiffer, during this trip. I also acknowledge and greatly appreciate the assistance of Steve Hakela, of Sand Point, in helping plan this trip and in picking us up at the end.

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Figure 1. Location of Cold Bay, Alaska and the route traveled. Campsites are shown as triangles.

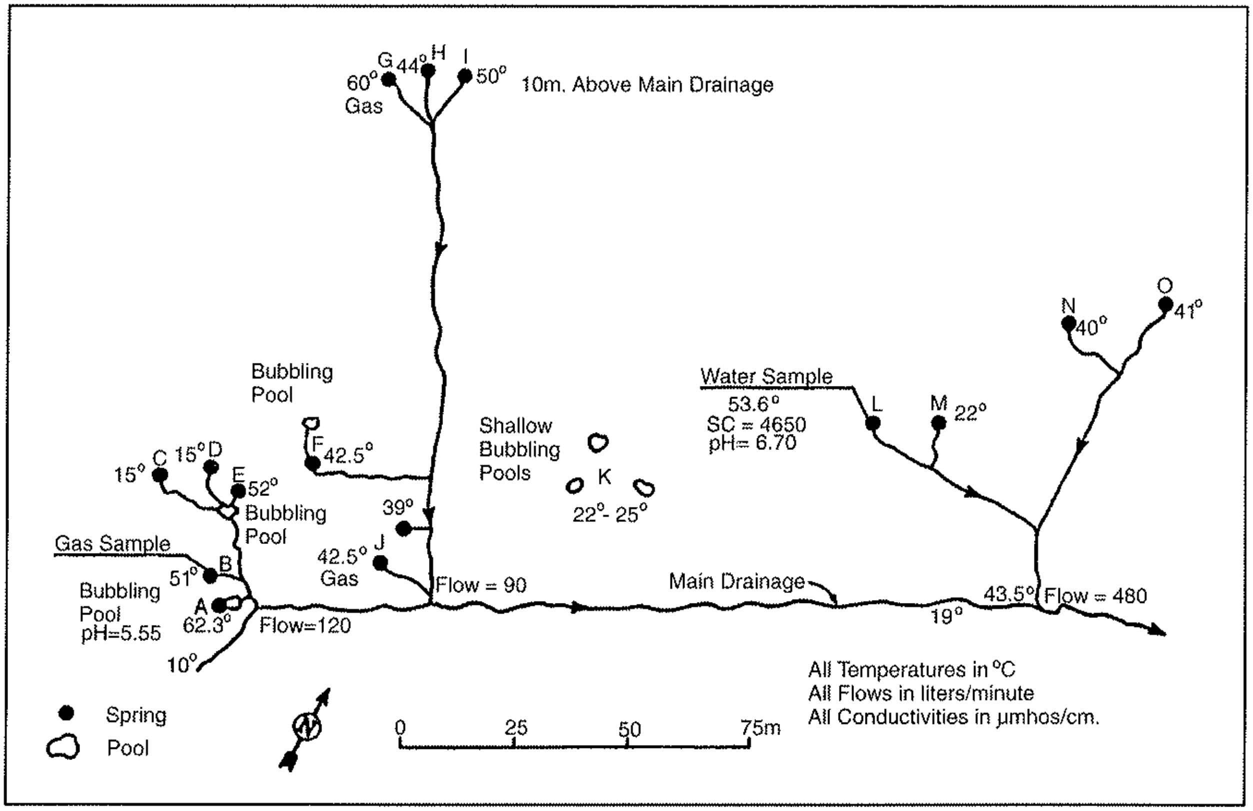

Figure 2. Detail at Cold Bay Hot Springs. From Motyka, and others (1981).

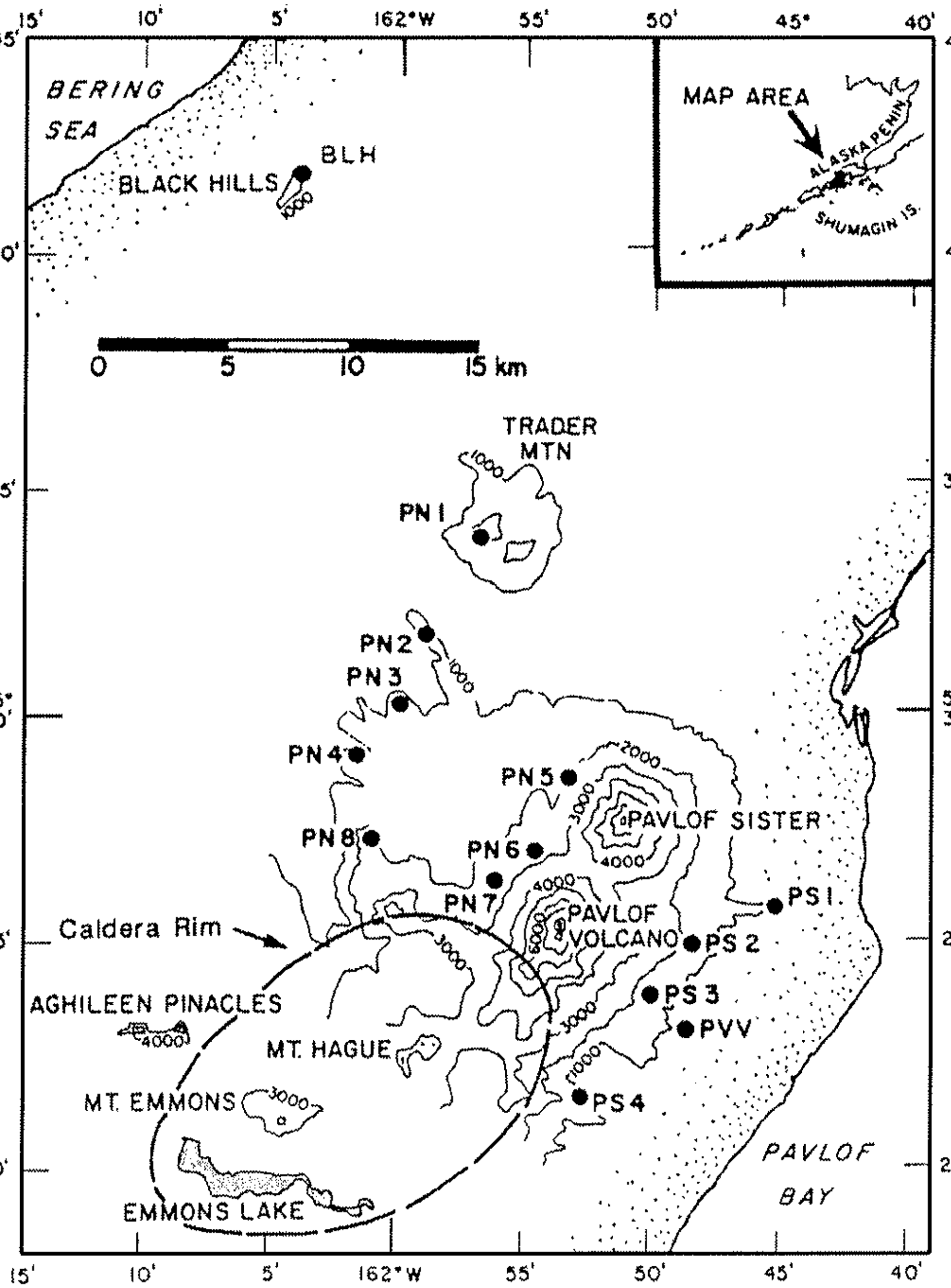

Figure 3. Location of Emmons Lake Caldera rim indicated by dashed line. Solid circles represent seismic stations. Modified from Newhall and Dzurisin (1988).

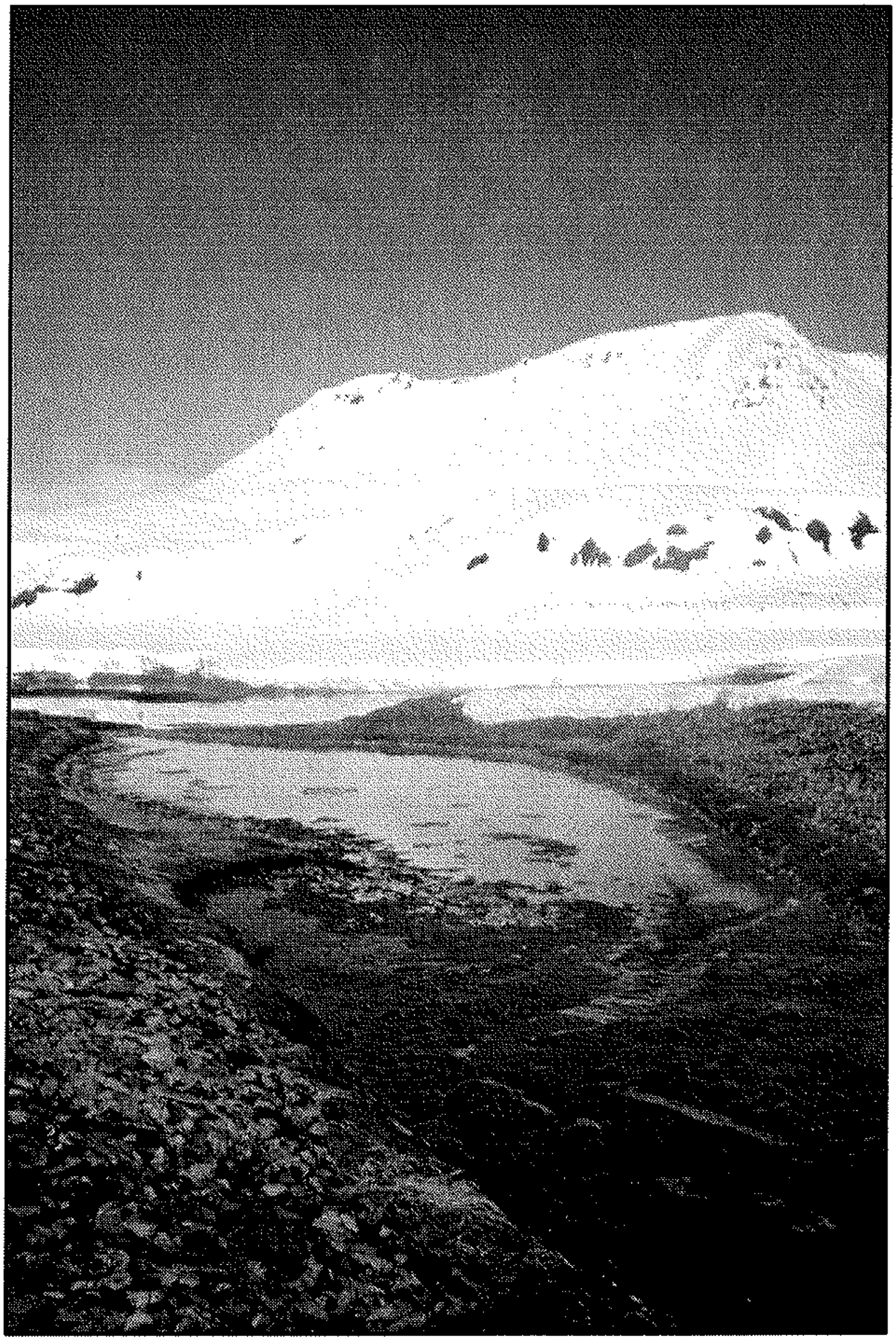

Figure 4. Emmons Lake Hot Springs and the view north-northeast.
Photo taken March 30, 1996 by Nancy Pfeiffer.

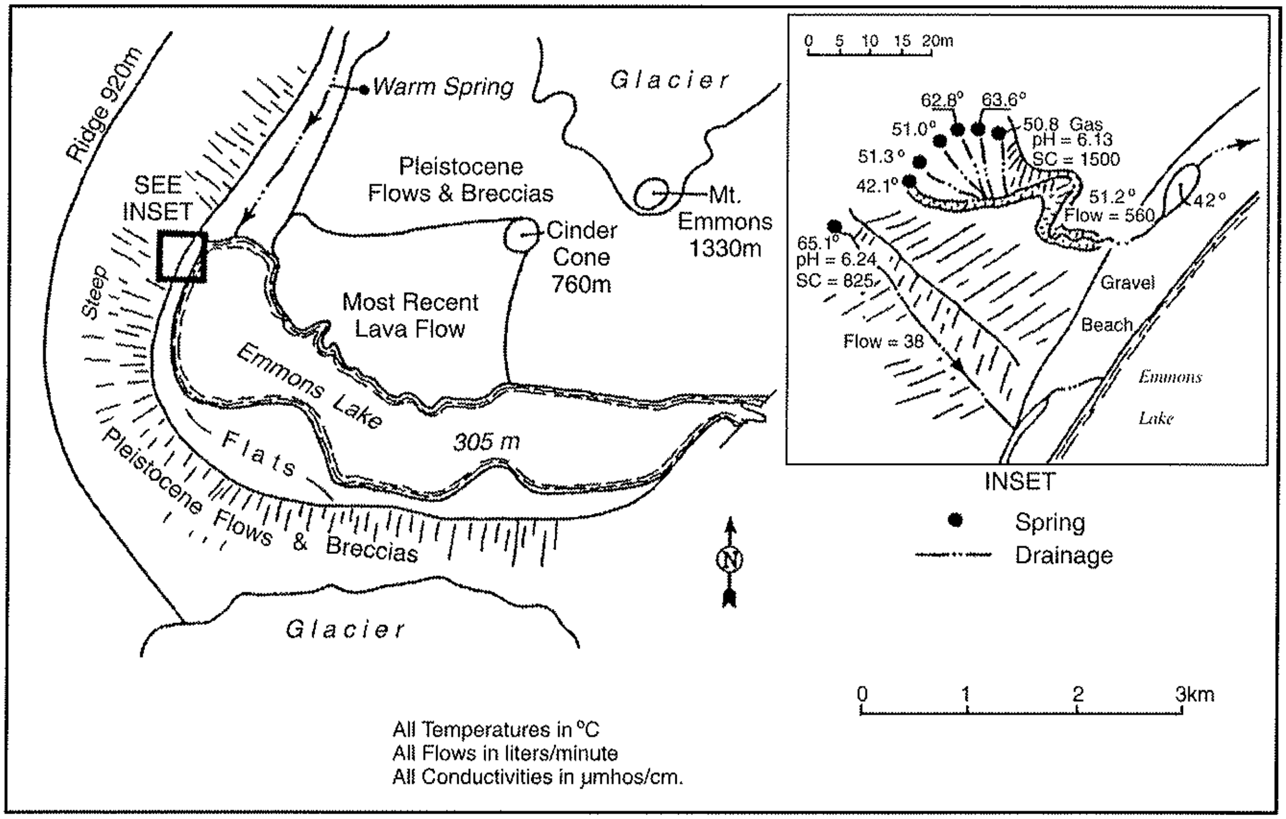

Figure 5. Detail at Emmons Lake Hot Springs. From Motyka, and others, (1981.)

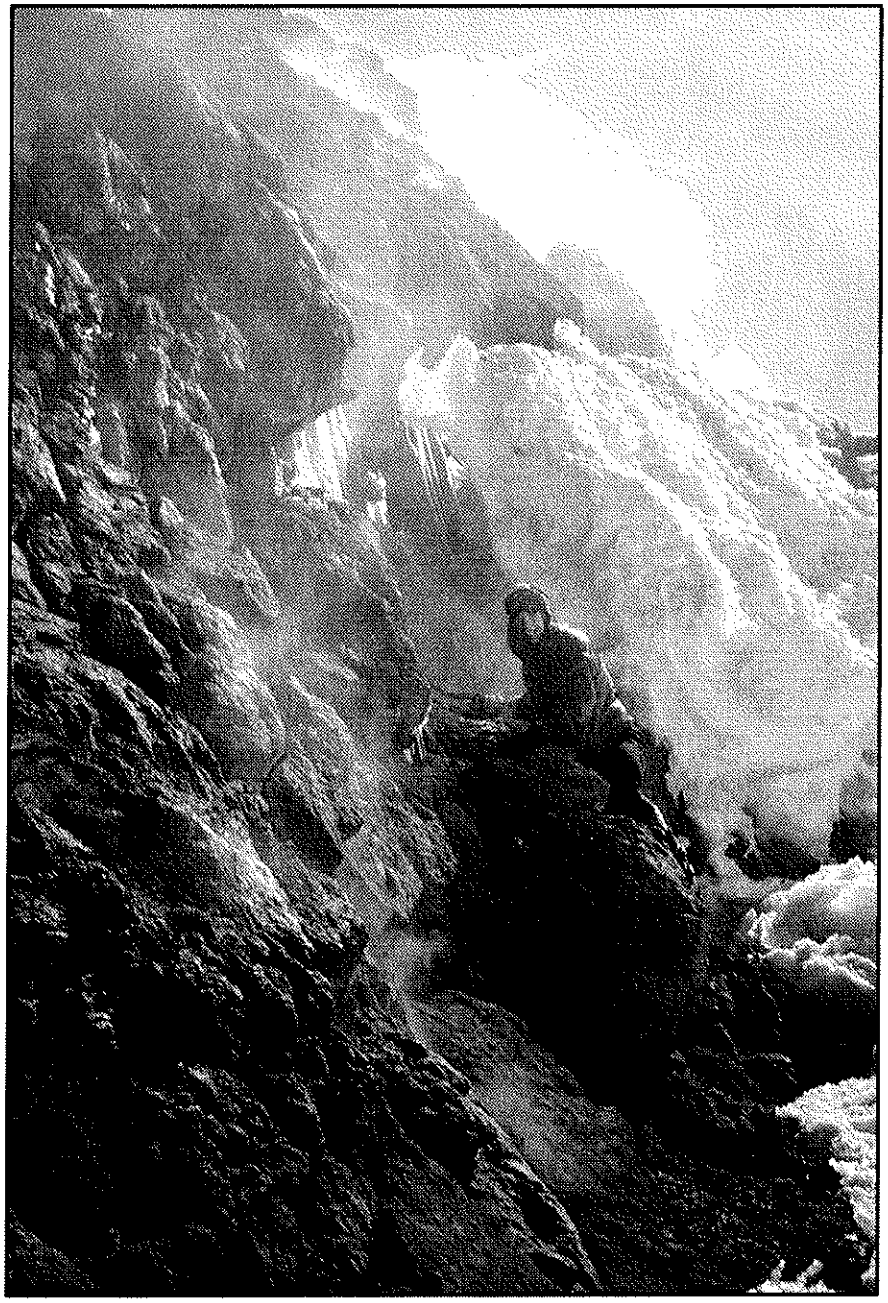

Figure 6. Fumaroles and steaming upper edifice of Pavlof's west flank. Photo taken 100 meters below summit by Nancy Pfeiffer, April 1, 1996.

Figure 7. Lower portion of an active fumarole field on the east flank of Mt. Hague.
Photo taken by Nancy Pfeiffer, April 6, 1996.

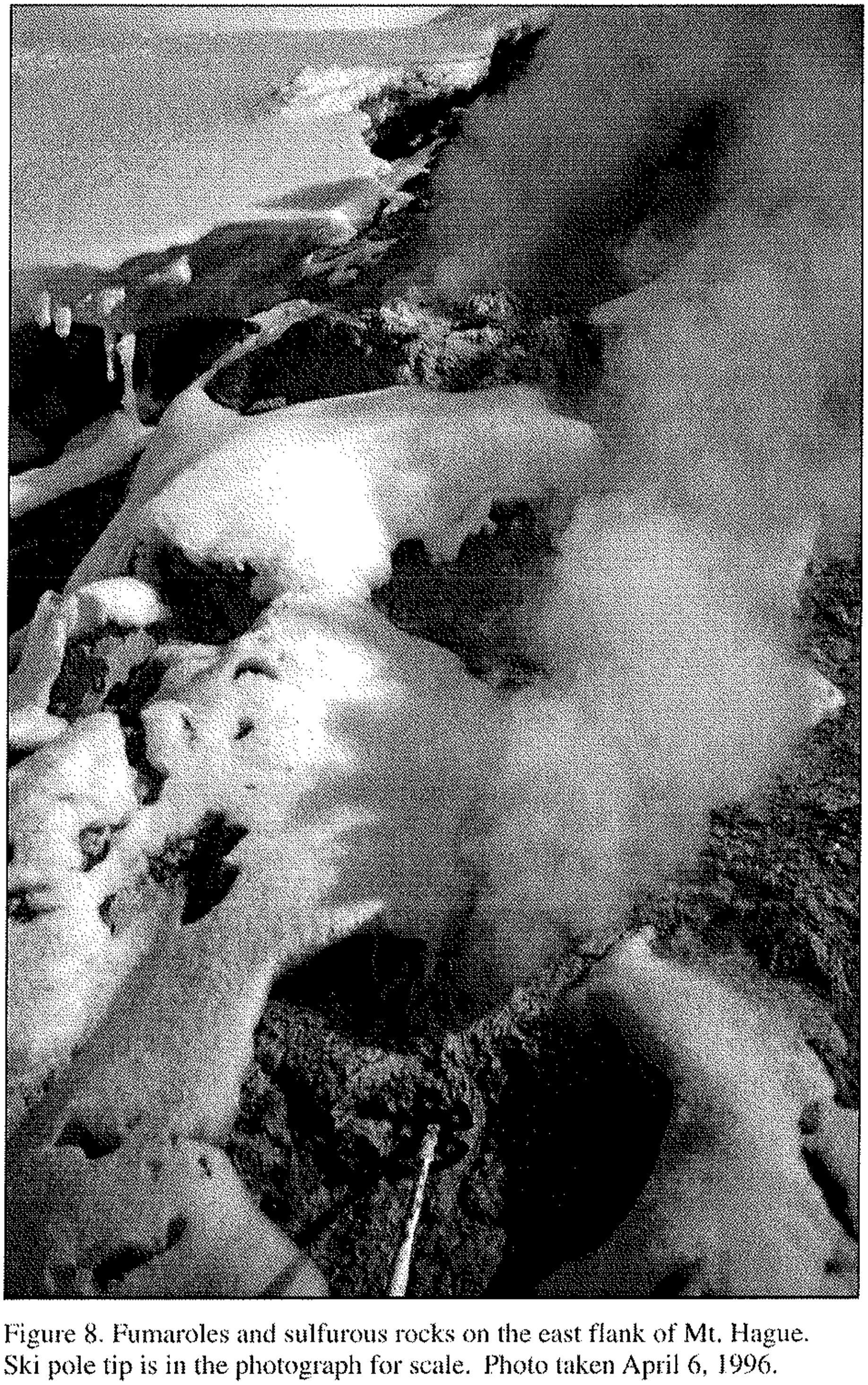

Figure 8. Fumaroles and sulfurous rocks on the east flank of Mt. Hague. Ski pole tip is in the photograph for scale. Photo taken April 6, 1996.